CLAIMS:

1. A transgenic mouse comprising a Flp transgene integrated in a genome of the transgenic mouse, wherein the Flp transgene is expressed in a cell of the transgenic mouse at a level of recombinase activity sufficient to catalyze recombination between Flp-recognition sequences of the cell.

2. The transgenic mouse according to Claim 1, wherein the genome further comprises a Flp-recognition sequence.

3. The transgenic mouse according to Claim 2, wherein the Flp-recognition sequence is SEQ ID NO:14 or SEQ ID NO:15.

4. The transgenic mouse according to Claim 2, wherein the transgenic mouse contains at least two diploid cells with different numbers of Flp-recognition sequences.

5. The transgenic mouse according to Claim 2, wherein the genome is hemizygous for the Flp-recognition sequence.

6. The transgenic mouse according to Claim 1, wherein the genome comprises at least two Flp-recognition sequences.

7. The transgenic mouse according to Claim 6, wherein the genome comprises at least two chromosomes, each chromosome comprising a Flp-recognition sequence.

8. The transgenic mouse according to Claim 1, wherein the genome further comprises two Flp-recognition sequences in direct repeat orientation.

9. The transgenic mouse according to Claim 1, wherein the genome further comprises two Flp-recognition sequences in inverted repeat orientation.

10. The transgenic mouse according to Claim 1, wherein the genome further comprises a Cre transgene.

11. The transgenic mouse according to Claim 1, wherein the genome further comprises a drug selectable marker transgene flanked by Flp-recognition sequences, wherein the drug selectable marker is excised in cells containing sufficient Flp recombinase activity.

12. The transgenic mouse according to Claim 1, wherein the genome further comprises another transgene flanked by Flp-recognition sequences.

13. The transgenic mouse according to Claim 12, wherein said another transgene is flanked by Flp-recognition sequences in direct repeat orientation.

14. The transgenic mouse according to Claim 12, wherein said another transgene is flanked by Flp-recognition sequences in inverted repeat orientation.

15. The transgenic mouse according to Claim 12, wherein said another transgene is selected from the group consisting of developmental gene, essential gene, cytokine gene, neurotransmitter gene, neurotransmitter receptor gene, oncogene, tumor suppressor gene, selectable marker, and histochemical marker.

16. The transgenic mouse according to Claim 15, wherein said another transgene is flanked by Flp-recognition sequences in direct repeat orientation.

17. The transgenic mouse according to Claim 15, wherein said another transgene is flanked by Flp-recognition sequences in inverted repeat orientation.

18. The transgenic mouse according to Claim 12, wherein expression of said additional transgene is activated in cells containing sufficient Flp recombinase activity.

19. The transgenic mouse according to Claim 12, wherein expression of said additional transgene is inactivated in cells containing sufficient Flp recombinase activity.

20. The transgenic mouse according to Claim 1, wherein Flp recombinase activity is regulated by a factor selected from the group consisting of chemical, developmental stage, temperature, and tissue type.

21. The transgenic mouse according to Claim 1, wherein the Flp transgene encodes amino acid sequence SEQ ID NO:17 or SEQ ID NO:19.

22. A transgenic mouse comprising a Flp transgene, wherein the Flp transgene is expressed in a cell of the transgenic mouse at a level of recombinase activity sufficient to catalyze recombination between Flp-recognition sequences of the cell.

23. A transgenic mouse comprising a genome which contains a Flp transgene and a Flp-recognition sequence.

24. A method of *in vivo* genetic engineering comprising:

(a) providing a transgenic mouse comprising a genome which contains a Flp transgene and at least two Flp-recognition sequences,

(b) expressing the Flp transgene at a level of recombinase activity sufficient to catalyze site-specific recombination in a cell, and

(c) catalyzing recombination between the two Flp-recognition sequences of the cell.

25. The method according to claim 24, wherein site-specific recombination occurs in a germ line cell.

26. The method according to claim 25, further comprising:

(d) mating the transgenic mouse to produce an offspring comprising a recombined genome which does not contain the Flp transgene.

27. The method according to claim 24, wherein site-specific recombination occurs in a somatic cell.

28. The method according to Claim 24, wherein at least one of the Flp-recognition sequences is SEQ ID NO:14 or SEQ ID NO:15.

29. The method according to Claim 24, wherein the genome comprises at least two chromosomes and each chromosome contains a Flp-recognition sequence, whereby recombination between the two Flp-recognition sequences causes chromosomal translocation.

30. The method according to Claim 24, wherein the genome comprises a chromosome and the two Flp-recognition sequences are direct repeats flanking a target sequence on the chromosome, whereby recombination between the two Flp-recognition sequences causes excision of the target sequence.

31. The method according to Claim 30, wherein the target sequence is a drug selectable marker.

32. The method according to Claim 24, wherein the genome comprises a chromosome containing a first Flp-recognition sequence and a target sequence containing a second Flp-recognition sequence, whereby recombination between the two Flp-recognition sequences causes insertion of the target sequence into the chromosome.

33. The method according to Claim 24, wherein the genome comprises a chromosome containing a first Flp-recognition sequence and a plasmid containing a transgene and a second Flp-recognition sequence, whereby recombination between the two Flp-recognition sequences causes insertion of the transgene into the chromosome.

34. The method according to Claim 24, wherein the genome comprises a chromosome and the two Flp-recognition sequences are inverted repeats flanking a target sequence on the chromosome, whereby recombination between the two Flp-recognition sequences causes inversion of the target sequence.

35. The method according to Claim 34, wherein expression of the target sequence is increased by the inversion.

36. The method according to Claim 34, wherein expression of the target sequence is decreased by the inversion.

37. The method according to Claim 24, wherein recombination causes activation of an oncogene or inactivation of a tumor suppressor gene in the cell, thereby transforming the cell and establishing a probability of developing cancer in the transgenic mouse.

38. The method according to Claim 37, further comprising:

(d) administering a candidate agent to the transgenic mouse; and

(e) identifying the candidate agent as a cancer promoter if the probability of developing cancer increases or a cancer inhibitor if the probability of developing cancer decreases.

39. The method according to claim 37, wherein the oncogene is selected from the group consisting of ABL1, BCL1, BCL2, BCL6, CBFA2, CBL, CSF1R, ERBA, ERBB, EBRB2, ETS1, ETV6, FGR, FOS, FYN, HCR, HRAS, JUN, KRAS, LCK, LYN, MDM2, MLL, MYB, MYC, MYCL1, MYCN, NRAS, PIM1, PML, RET, SRC, TAL1, TCL3, and YES.

40. The method according to claim 37, wherein the tumor suppressor gene is selected from the group consisting of APC, BRCA1, BRCA2, DCC, MADH4, MCC, NF1, NF2, RB1, WT1, and TP53.

41. The method according to claim 24, wherein Flp-mediated recombination activates ectopic expression of a developmental gene.

42. The method according to claim 24, wherein Flp-mediated recombination inactivates post-embryonic expression of a developmental gene required for embryonic development of the transgenic mouse.

43. The method according to claim 24, wherein Flp-mediated recombination identifies a cell lineage in the transgenic mouse.

44. The transgenic mouse according to Claim 24, wherein the Flp transgene encodes amino acid sequence SEQ ID NO:17 or SEQ ID NO:19.

45. A system for genetic manipulation, comprising:

(a) the transgenic mouse according to Claim 22, and

(b) a purified nucleic acid comprising a Flp-recognition sequence.

46. The system according to Claim 45, wherein the Flp-recognition sequence is SEQ ID NO:14 or SEQ ID NO:15.

47. The system of claim 45, wherein the purified nucleic acid further comprises a sequence selected from the group consisting of developmental gene, essential gene, cytokine gene, neurotransmitter gene, neurotransmitter receptor gene, oncogene, tumor suppressor gene, selectable marker, and histochemical marker.

48. The system of claim 45, further comprising:

(c) means for producing a transgenic mouse comprising a genome which contains the Flp-recognition sequence.

49. The system of claim 45, wherein the Flp transgene encodes amino acid sequence SEQ ID NO:17 or SEQ ID NO:19.

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